General Motors Corporation

Driver Distraction and Safety

Safety of our highway transportation system is a critical interest for all Americans. Motorists are spending 500 million miles a week in their vehicles. It is important to GM to make this time safe for vehicle occupants. At the same time, many of them want these travel hours to be more productive. In-vehicle communication systems offer significant benefits in time efficiency and used correctly have demonstrated value in improved personal safety, the ability to quickly summon medical help to a crash scene, to report impaired or aggressive drivers, etc.

Driver attentional distraction has been one of the leading causes of crashes since police reporting began. Responding to changes in the external driving environment must be the driver's priority task, but a driver typically balances this along with conversations with other passengers, thinking about work, home, family, dealing with small children, eating, and sometimes distraction from in-vehicle devices. All of these elements contribute to a driver's visual and cognitive workload. Ultimately, safety in properly balancing these tasks remains in the hands (and mind) of the driver.

GM has developed and is implementing in our vehicles a set of common sense principles to guide how information delivery systems are designed into its automobiles. GM believes they will assist drivers in a proper balance. These include:

- minimizing the amount of time drivers take their eyes off the road or hands off the wheel
- minimizing the number of steps required to complete a task using these devices
- creating systems that look and function similarly in GM vehicles.
- making particularly demanding tasks unavailable while driving

Our goal is to allow customers safe communication, by designing systems that limit the amount of unnecessary and excessive attention demands on a driver while he or she is driving. At their discretion today, drivers are using a variety of hand held (non-automotive) devices in their vehicles to satisfy a need for expanded access to information. The operator interface on these devices is not typically designed for use while driving. In addition, some drivers might perform several functions at once using multiple non-integrated devices.

GM products to date have reflected the advantages of this approach. OnStar's automated collision notification has brought emergency response to vehicles much more rapidly than could be expected otherwise. Access has been through a simple 3 button system. With the advent of personal calling, this driver interface will become voice activated. In 2001 MY, Cadillac will introduce a system that integrates customer-requested on-board capabilities with a wireless communication platform. This system is activated and operated through voice command.

GM has a long record of scientific study of human to vehicle interaction. Many of GM's publications are directly relevant to scientific understanding of driver distraction. Examples of one such technical publication, and several active projects are attached. Industry and government research is needed to develop practical, repeatable driver workload metrics and procedures for both visual and cognitive demand that can realistically assess which types of driver interface tasks are appropriate to perform while a vehicle is in motion. GM has joined with other OEMs to propose a joint research project with US-DOT under it's Intelligent Vehicle Initiative to develop the needed science. In the future, vehicle OEMs will be able to use objective workload evaluation procedures to assess the effect of in-vehicle tasks on overall driving workload. GM also intends to study methods of communication and training to guide customers in responsible use of these devices while driving.

Attachments:

1) Quantifying Head-Up Display Pedestrian Detection Benefits for Older Drivers, Raymond J. Kiefer (GM) 98-S2-O-10
2) General Motors Establishes Satellite Research Lab At Carnegie Mellon University
3) US Transportation Secretary Slater Announces $35 Million Joint Research With General Motors On Vehicle Crash Warning Systems

Attachment 1:

Quantifying Head-Up Display Pedestrian Detection Benefits for Older Drivers

Raymond J. Kiefer

(GM) 98-S2-O-10

GMNA Safety Center
6/30/00

Note: The text of this paper has been provided for posting at this site, but is being re-formatted so that it can be put up here. For now, the reference & abstract appear below, with the paper to follow soon.

Quantifying Head-Up Display (HUD) Pedestrian Detection Benefits For Older Drivers

Raymond J. Kiefer

General Motors North American Operations Safety Center

United States

Paper Number 98-S2-O-10

Paper from the *Proceedings of the 16th International Technical Conference on the Enhanced Safety of Vehicles* (pp. 428-437). Washington, D.C.: National Highway Traffic Safety Administration. 1998.

Abstract

The current research was aimed at quantifying the potential head-up display (HUD) pedestrian detection benefits for older drivers. In a parked vehicle on a closed-course, test participants were required in rapid succession to read a digital speedometer (positioned either head-up or head-down) and a distant speed limit sign. 24 drivers were tested ranging from 59 to 71 years old. Liquid-crystal glasses were used to limit the driver's view of the forward scene to the time period immediately surrounding display glances. In the second half of testing, subjects were told that during a few trials a pedestrian would appear. On these trials, subjects were to immediately press a button. During these pedestrian trials, results indicated a HUD detection time advantage and a trend toward fewer missed pedestrians with the HUD. Indeed, 7 of the 9 fastest mean pedestrian detection times across all 16 conditions tested occurred in HUD conditions. These

results clearly suggest HUDs improve the driver's ability to see forward scene events (and hence, potentially traffic safety) surrounding display glances.

Attachment 2:

General Motors Establishes Satellite Research Lab At Carnegie Mellon University

For Release: November 12, 1999, 8:00a.m.
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GENERAL MOTORS ESTABLISHES $3 MILLION SATELLITE RESEARCH LAB AT CARNEGIE MELLON UNIVERSITY

Lab to focus on vehicle information technology research

WARREN, Mich. -- General Motors and Carnegie Mellon University have agreed to conduct joint research into vehicle information technology by creating a $3 million satellite lab at Carnegie Mellon in Pittsburgh.

"GM's intent is to be the industry leader in product innovation, including vehicle information technology," said Dr. Lawrence D. Burns, vice president of GM Research & Development and Planning. "Supplementing on-going work within General Motors in critical research areas by forming alliances with top academic institutions speeds technology development. Such partnerships allow the exchange of technical knowledge and accelerate the pace of innovation."

"This is an exciting new partnership that brings together two world-class organizations," said Carnegie Mellon President Dr. Jared L. Cohon. "Our university, and particularly our College of Engineering, has always been focused on bringing the power of research and discovery to bear on addressing business issues and pursuing business opportunities. This collaboration promises to foster innovative thinking that will ultimately benefit consumers of General Motors products."

The technologies that will be made possible through this joint effort support GM initiatives to allow passengers and drivers of GM vehicles to easily access a wide array of information and entertainment services in their vehicles. The projects that will be pursued within this lab will focus on developing an integrated, in-vehicle electronic architecture and computing infrastructure.

The satellite lab will be co-directed by Drs. Roger Fruechte of GM Research & Development and Planning and T.E. Schlesinger of Carnegie Mellon. Although the satellite laboratory will be housed in Carnegie Mellon's Department of Electrical and Computer Engineering, research projects will be performed by scientists at both GM R&D facilities in Warren, Mich., and from various departments on campus.

"As we enter the 21st Century, collaborative relationships will serve as catalysts to merge the transportation and communications world and reframe transportation as we know it," Burns said. "Technology networks, such as this type of partnership, will function as incubators for new ideas. We fully intend to win in this race for the future -- the fastest way to deliver innovation to market is to work together."

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For more information about GM: http://media.gm.com For more information about Carnegie Mellon: http://www.cmu.edu

Attachment 3:

US Transportation Secretary Slater Announces $35 Million Joint Research

With General Motors On Vehicle Crash Warning Systems

GMNA Safety Center
6/30/00

FOR RELEASE: June 24, 1999
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U.S. Transportation Secretary Slater Announces $35 Million Joint Research With General Motors On Vehicle Crash Warning Systems

BOSTON--At a national conference about innovation in transportation, U.S. Transportation Secretary Rodney E. Slater today announced a $35 million joint research effort into vehicle crash-warning systems by the U.S. Department of Transportation and General Motors Corp.

"President Clinton said that research is critically important to the nation, helping foster the discovery of knowledge, stimulating technological innovation, improving the quality of life and contributing to America's prosperity," Secretary Slater said. "This innovative research project is especially important to safety, which is President Clinton's highest transportation priority and I am pleased that General Motors is joining us in this endeavor."

The joint U.S.-GM research will create prototype crash-warning systems. It also will involve extensive testing of collision avoidance technology in real-life situations. The new systems will caution drivers about potential hazards ahead of them by means of audible tones and visual displays.

"Our objective with this real-world study is to develop and integrate key technologies that can accelerate the introduction of a cohesive vehicle package with both forward collision warning and adaptive cruise control," said Dr. Lawrence D. Burns, vice president for GM Research & Development and Planning, the lead GM unit for the program. "This research underscores our belief that the best crash protection we can provide is to help people avoid the collision altogether."

Collision warning technology helps prevent crashes by detecting and assessing hazardous conditions in a vehicle's forward path, such as a rapidly decelerating or stopped vehicle, and alerting the driver. Adaptive cruise control can adjust the speed of a vehicle to match that of another one in front of it.

According to the U.S. Department of Transportation, more than one-fourth of all injuries in motor vehicle crashes result from rear-end collisions, which are the focus of the research.

The $35 million Intelligent Vehicle Initiative (IVI) research project, which is the largest of its kind, will run for five years and is expected to be launched later this month. It is the first IVI operational test under the Intelligent Transportation Systems (ITS) program, which was authorized by the Transportation Equity Act for the 21st Century (TEA-21).

The ITS project will involve a 61 percent federal contribution, with the balance coming from GM and Delphi Automotive Systems. Its goal is to measure the performance of the new collision warning systems. Also, the research will provide valuable information on driver acceptance of the technology.

The first half of the five-year program will involve pre-development of prototype vehicles equipped with the crash avoidance technology. The second half will include field testing of the prototypes and will involve more that 100 licensed drivers from Michigan. Drivers will be selected to use one of 10 vehicles, each equipped with a collision warning package and adaptive cruise control.

Each test driver will have unrestricted use of a specially equipped vehicle for at least two weeks. Data will be collected by on-board recording devices, in post-test interviews and at clinics that help gauge customer acceptance, among other factors.

A primary partner in the field research is Delphi Delco Electronics Systems, which will provide expertise, along with GM, in adaptive cruise control, forward collision warning and driver interface. GM also will lead the vehicle systems integration and assemble the vehicles.

The research will be conducted at GM facilities in Warren, Mich., along with Delphi Delco Electronics facilities in Kokomo, Ind. and Malibu, Calif. The University of Michigan Transportation Research Institute (UMTRI) will manage the field testing. The U.S. Department of Transportation's Volpe National Transportation System Center in Boston will analyze the field data.

Secretary Slater announced the U.S.-GM joint research project during remarks at the U.S. Department of Transportations's "Spirit of Innovation in Transportation" Conference at the John A. Volpe Transportation Systems Center in Cambridge, Mass. The conference is exploring ways of ensuring that the country's transportation system will continue to benefit from new advanced technologies.

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